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# An Enrichment Program in Science for Gifted Children in Grades One and Two

Margery Alice Skeen
*Central Washington University*

# AN ENRICHMENT PROGRAM IN SCIENCE FOR GIFTED CHILDREN IN GRADES ONE AND TWO

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Margery Alice Skeen

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Dohn A. Miller, COMMITTEE CHAIRMAN

John E. Davis

John Schwenker

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# CHAPTER I

## INTRODUCTION

During three years of teaching, the writer has seen very little science taught in the primary grades. The writer has seen even less enrichment in science for the gifted child. There have been several reasons given by teachers for this slighting of science. The most common one is, "I don't have time to teach science, because I must teach so much reading and arithmetic." Another common excuse is that "The children are too young to learn science - they won't understand it." It is the writer's opinion that neither of these arguments can be considered valid. The teacher who doesn't have time to teach science is probably not planning as well as she might. If one or two hours per week cannot be devoted to an important subject like science, then the school week is not being properly divided into time segments. If a certain time each day or each week is planned to be devoted to science, it will be taught. Authorities on the subject of science education agree that incidental teaching is an important part of the teaching of science. "...instruction in science at the kindergarten and primary levels need not be set off into sharply defined units or grades." (24:364) If a child brings an interesting object to class to share, a science lesson can be conducted on the spot. A sudden change in the weather might motivate the children to want to learn "about clouds" or some other part of the subject of weather. "Not having time for science" is not a realistic excuse for not teaching it.

Perhaps the "importance of science" is questionable to some people. Our entire life is surrounded and governed by science. Weather, gardening, modern conveniences such as electrical appliances and running water, pets, sports activities and sports equipment, musical instruments - all these involve science in some way, and through science can be made better understood and therefore more interesting. All people are sometimes in contact with something concerned with science. Why not make those things as interesting as possible by knowledge of the scientific principles involved, and thus make life more interesting?

The argument that primary age children are too young to understand science certainly has been disproved many times. Some concepts might be too advanced for children of this age, but there are so many concepts that can be learned. If this learning is possible, then it should be taught. "Children are capable of understanding many science concepts. Depriving them of opportunities to explore and study in the field of science appropriate to their needs would be depriving them of optimum growth in school." (10:327) Why wait until the child is older, and waste all that time? Some concepts that could be considered too difficult for the primary age child actually have been learned by average intelligence children. An example is the concept of specific gravity. This concept was taught to 5 to 7 year olds by Ojemann and Pritchett during a study criticizing some ideas advanced by Piaget. (17:184-192) If a concept like this can be learned by an average child, imagine the possibilities for a gifted child.

The writer has taught a unit in astronomy for the past two years to an average second grade class. The concept of great distances measured by light years was not attempted to be taught, but discussions of planets, stars, satellites, comets, meteors and meteorites were held with the children and understood by them. They were very interested in constellations, and several children learned many of the names and locations of these "star pictures". If all this can be learned by seven and eight year olds, then it should be taught.

Some teachers do very little with science in their classrooms because they feel inadequate to teach it. The following quotation should answer their problem.

> Perplexing problems which some teachers confront in teaching science result in part from their own limited experience with science in high school and college. Some teachers have few scientific concepts, have done few controlled experiments, and do not know how to use resources in the immediate environment for science instruction. Even so, any teacher may learn with the children and share with them the thrill of formulating scientific concepts and doing experiments. (24:389)

In using the program presented in this paper, the teacher should not try to follow it step by step or in the order of subjects presented. The subjects and concepts are presented so that the teacher may choose from those that seem most appropriate for the particular children at the particular time. These suggestions are not presented as an outline of a month's work or even a year's work. They merely present some of the scientific interests that may be found in children of above average intelligence in grade one or two. The teacher may enlarge upon any of the subjects or concepts according to the individual abilities, interests, and maturity of the children. "Teachers should expect to find differences in the ways in which children respond to science, and should not strive to make the children's reactions identical." (4:8)

> Teachers should expect a wide span of differing interest in science. Some children will like to study animals; others electricity; and still others, the stars. But by careful planning the teacher can cause a child who had shown an almost exclusive interest in animals to become interested in electricity, and so on. A teacher can help children develop an interest and a challenging attitude toward almost any subject in science, if the subject is properly adjusted to their abilities and experiences. (4:21)

This paper supplies many concepts and methods of demonstrating or proving those concepts; it does not attempt to adjust those methods to the individual child. That is the job of the teacher.

## 1. THE PROBLEM

*Statement of the problem.* This paper is a review of the literature and presents a number of suggested concepts that could serve as an enrichment program in science for the gifted child in grades one and two.

*Limitations of the study.* Many of the concepts are appropriate only for the bright and gifted children of grades one and two. No attempt has been made to fit the concept or method to the individual child - that is the job and responsibility of the teacher. Only a few of many possible areas of science have been covered. Those covered were selected on the basis of the writer's experience as to which subjects are most interesting to children in grades one and two, and on the basis of the writer's experience as to which subjects seem to be neglected most often by teachers of grades one and two.

## II. DEFINITIONS OF TERMS USED

Gifted. The term "gifted" includes those children in grade one or two who have an I.Q. of 120 or above as tested by the Stanford-Binet or Weschler Intelligence Scale for Children.

Concept. The term "concept" means a specific fact or belief related to a general idea or area of study.

Enrichment. "Enrichment" means any work or study above and beyond the normal classroom curriculum.

## CHAPTER II

## REVIEW OF THE LITERATURE

Most of the information about teaching the gifted child in the normal classroom is contained in books on the exceptional child or in books devoted entirely to the gifted child. However, in both types of book, there are only small sections on teaching the specific subject areas, if there is mention of a specific subject at all. The teaching of science seems to have the most information, perhaps because many people in the field feel that only the above average and gifted are capable of delving into the depths of the subject.

In a bulletin published by the Connecticut State Department of Education called Education for Gifted Children and Youth, (11:Ch. 3) it is suggested that the gifted child needs to have the opportunity to "work intensively in his fields of special interests and aptitudes. He needs a wealth of material for study and research, experimentation, and self-expression." (11:18) The bulletin suggests that centers be arranged in the classroom, and that the following items be included in the science center: microscope, scales, terrarium, barometer, and science kit of basic materials. Mentioned also is the idea of resource people, such as a boy who is interested in geology getting help from a geology professor or a high school science teacher. Community resources such as the public library, and any industrial developments that would be suitable for the child are an important part of enrichment in science.

A small handbook called Meeting Individual Differences in Palo Alto - The Gifted Child (29) recommends the following list of activities to enrich the science program in the elementary classroom: a science fair, forming a science group, having a weekly science demonstration, utilizing high school and junior high school students to demonstrate experiments, bringing in scientists from the community, and excursions to places where science is in action. (29:29)

Other sources have more detailed and more plentiful ideas for enrichment in science. One of these is Teaching the Bright Pupil, by Adams and Brown. (2) The first idea is a balanced aquarium. The proper oxygen-giving plants must be obtained, and their names placed on labels pasted to the aquarium. The correct number of fish for the size of the tank must be ascertained, and then the fish themselves selected. The problem of light and sunlight must be solved. The theory of the balanced aquarium can then be explained, i.e. the fish give off carbon dioxide and the plants give off oxygen.

Another project suggested by Adams and Brown is to make studies of the protective colorations of animals. This could involve pictures, articles, charts, lectures by the pupils, or selected films. The book puts this activity on the secondary level, but it has been done successfully in the primary grades.

A different project, but one still dealing with nature, is to take samples of pond water and study it with the use of a microscope. Drawings might be made of the small life found in the water. Again, the pupil could present his findings to the class.

A suggestion made in the book by Adams and Brown, as well as in several other sources, is that the pupils study the lives of famous scientists. Adams and Brown suggest that committees of pupils could dramatize some important incidents in the lives of these men, such as the thing they are best known for.

Study of the constellations, the planets, the sun, and the moon is suitable to the gifted child in the primary grades on a limited basis. The names of the planets and the more common constellations can be learned, and charts made of the sky as it appears during the various seasons of the year.

Other ideas are presented by Adams and Brown, but most of them would not be suitable to the primary grades.

Another source that has a section devoted to the teaching of science in the primary grades is The Gifted Student, by William K. Durr. (9) He divides the activities into "Study Activities," "Making Activities," and "Group Activities." In the "Study Activities" he makes the following suggestions: collect some common superstitions and see if there is any scientific evidence for or against it (such as rubbing a frog will cause warts); make a study of the history of some household appliance, such as the refrigerator, from its earliest beginnings to the present; study the migration of birds, in general or of one particular bird; keep a list of the illnesses that pupils in the classroom had over a certain period of time, and try to determine any conditions or factors associated with the illnesses; choose a planet and make a thorough study of it; pretend it is possible to take a trip to it and describe what the trip would be like; study the communication systems of animals other than man; study the history of the telescope; study the lives of selected scientists in one particular field of science; study the changes made in predicting the weather, modern equipment and methods. "Making Activities" include: collect seeds during the fall of the year, and arrange a display with name, methods of dispersal, and any other method of classification; plan, prepare, and maintain an aquarium; select a natural resource that is important to man, such as wood, and learn as much as possible about it - its uses to man, its growth and development, etc.; build a bird feeding station to be placed on the school window sill; set up and maintain a science center in the room, using a certain theme, but changing it often; make models of simple machines and demonstrate their use; save the weather maps and predictions in the daily newspaper, and see how accurately the weather was predicted. "Group Activities" include: construct a magnetic puppet show, using a strong magnet and figures with a steel base. Use the bottom of a shoe box as the stage. When the magnet is moved around under the figures, they will move too. Present a play. Write a script for a play about a trip to another planet; other students can help write the play. Study the pulse rates of pupils under varying conditions, such as after resting, after mild exercise, and after strenuous exercise. Plan and organize a Science Fair for the school. Organize a Science Club in the school. (9:136-145)

Laycock, in Gifted Children, says that the elementary school teacher has a real foundation on which to base science teaching - the child's great curiosity about almost everything in his environment, his desire to explore and experiment, and his search for explanations. The teacher's job is to keep alive this curiosity, to help the child refine the methods by which he seeks answers to his questions and to encourage him to test his results. (25:117)

General principles in teaching science to the gifted child are presented in Laycock's book. "Teach the use of the scientific method in solving daily problems." (25:118) For example, show that making purchases of importance or solving other personal problems can be solved using the same method as is used in studying the stars, weather forecasting, and other scientific activities. "Encourage reading in the history of science." (25:119) "Study course outlines in science." (25:119) Let the gifted child see outlines in science for the elementary school to get an overview of the general field of science. This will let him see the wide variety of the use to which man has put the scientific method in solving such of his problems as food, clothing, shelter, transportation, communication, health, agriculture, industry and warfare. "Contemporary influence in science." (25:119) Help the child see the tremendous influence which contemporary national and world events have had on the development of science and on the type of science education in schools.

Under methods of enrichment, Laycock mentions several activities. General and supervised reading in science should be encouraged. There are several good encyclopedias, and many good magazines available in most school libraries and all public libraries. Full use should be made of all libraries - school, room, community, county, etc. Another activity is making use of filmstrips and films in the field of science. If it is not shown to the entire class, perhaps the gifted child could see it during his free time. If it is to be shown to the class, the gifted child might be able to help in making a decision between two films on the same subject, or might be able to prepare the class for it. Field trips are suggested. The child should be encouraged to read and investigate as much as possible before the field trip, and then follow up afterwards. This may result in an article for the school or town newspaper, or in a report to the class, or a display on the class bulletin board. Laycock says that individual projects give the child practice in planning, in critical thinking, and in the use of the scientific method. It gives him an opportunity to formulate problems, advance hypotheses for their solution, plan his experiments, test his hypotheses, interpret principles, evaluate authorities, and withhold judgment until the evidence is in. In selecting projects the following must be taken into account: the child's interests, his background (Is it sufficient to carry out the project?), and whether the necessary supplies, equipment, and references are available. Primary grade projects might be: gardening, bird study, insect study, pets and their care. One other suggestion of Laycock is for the gifted child to make collections. Those mentioned include: rocks, insects, flowers and leaves, live animals (fish, hamsters, guinea pigs, snakes, turtles, frogs, earthworms, silkworms), the making of bird houses and bird feeders, experimenting with germinating seeds, making a planetarium, stamps, coins, and mineral specimens. (25:120-130)

In Curriculum Planning For the Gifted by Louis A. Fliegler, J. Stanley Marshall has written a chapter entitled "Science in the Elementary School". (12) After identifying the gifted and giving examples of gifted children, Marshall discusses how to build an adequate science program, and finally suggests some project ideas for children gifted in science. He stresses the idea that a special program should involve the child in "working with science at the advanced level of ideas and concepts and relationships. It should allow him to search for answers, to discover scientific information on his own." (12:141) Project ideas Marshall suggests include the following:

1. Have the student read about phases of astronomy, the sun, moon, stars, and planets. Legends about the stars could be read and reported on to the class.

2. Observe the moon, stars, and planets through a telescope. Find constellations.

3. Have the child visit a planetarium and make a report to the rest of the class. Perhaps printed materials could be obtained from the planetarium that could be correlated with school studies.

4. Open ended questions include the following that might be asked of a gifted child in the primary grades: Does the North Star seem to move? Do the other stars and constellations seem to move during the evening? If so, in which direction? In what direction does the moon cross the sky? Can you see the same constellations in the winter that you see in the summer? Does the moon rise at the same time each night? An activity suggested for intermediate aged children but that could be performed by younger children is to have the child demonstrate lunar and solar eclipses with the use of a light, a baseball, and a golf ball. (12:140-144)

In general, the literature concerning the teaching of science to the gifted child supports the idea of enrichment. This will include much individual work, work that is worthwhile to the student and from which he will learn. It must not be just a lot of busy work.

# CHAPTER III

## THE ENRICHMENT PROGRAM

The following chapter suggests concepts for several phases of science. They are arranged according to subject. Most of the experiences may be accomplished in the classroom; a few need more space or other facilities. Nearly all may be duplicated at home if the child is allowed to have the proper equipment. The experiences have been designed to allow for much independent work on the part of the child. Most need some teacher direction at first however, and it is the teacher's responsibility to obtain the needed materials. (Many of the materials will be brought in by children.) All experiences should be suitable for a gifted child in a normal first or second grade classroom.

Many of the suggestions listed in this chapter were found in the sources listed in the bibliography.

# I. ELECTRICITY

CONCEPT: A complete circuit is necessary for effective use of electricity.

Make available the following materials: 1.5 volt dry cell, flashlight bulb, small screw driver, three pieces of insulated wire with the insulation removed for about an inch at each end. Tell the child to make the bulb light. After some experimentation or some help from the teacher if necessary, the set up should be as follows: one wire attached to one terminal of the dry cell; another wire attached to the other terminal of the dry cell and also to the light bulb; the third wire attached to the other terminal of the light bulb; the two loose ends of wire touching for the complete circuit that will cause the bulb to light. Discuss the complete circuit, giving the understanding that it is necessary for the use of electricity in such a situation.

CONCEPT: Some materials will conduct electricity; others will not conduct electricity.

Set up a dry cell, light bulb, and three wires in a complete circuit. Instead of touching the two free wire ends together, touch them both to different objects such as rocks, pencils, spoons, nails, plastic, wood, water, and any other suitable materials. Try to reach generalizations about the type of material that will conduct electricity.

CONCEPT: An electromagnet is made when electricity flows through a metal object.which will conduct electricity.

Make available the following materials: 1.5 volt dry cell, three pieces of insulated wire with the insulation removed for about an inch at each end, a large nail, and several iron thumbtacks. Set up a complete circuit with the nail attached to dry cell by wrapping the wire around it several times. Touch the two loose pieces of wire and hold the nail close to the tacks. The nail will act as a magnet and attract the thumbtacks. Experiment with the number of wraps of wire around the nail to see how to make the electromagnet stronger or weaker.

CONCEPT: Static electricity can be produced by rubbing certain materials together.

Have the child comb his hair, stroke a cat's back, rub a rubber comb on a wool sleeve, hold tissue paper against the blackboard and rub it rapidly with a silk cloth, etc. to see the results of static electricity. After charging a comb, hold it to small bits of paper and see if they are attracted. Put two thin books on a table a few inches apart. In the space between them place some tiny bits of paper. Place a piece of glass over the books and the space between them. Rub the glass vigorously with a piece of silk or nylon and see what happens to the paper.

CONCEPT: A charged body attracts a neutral one; two charged bodies repel each other.

Hang two inflated balloons from threads so that they may swing freely but may touch each other. Rub one balloon with wool. It should attract the other. Now rub both balloons with the wool. They should repel each other.

CONCEPT: Static electricity experiments work better on dry, cold days than on humid, warm ones.

Let the child or children experiment on different types of days to see that the above concept is true.

## II. MAGNETS

The following magnets and materials should be provided: a piece of lodestone, a pair of bar magnets, a small and a large horseshoe magnet, iron filings, nails, tacks, small pieces of many other kinds of materials.

CONCEPT: Magnets attract objects made of iron and steel.

Make available different kinds of materials, such as paper, rubber bands, chalk, pieces of wood, coins, paper clips, nails, pins, etc. Have a child bring a magnet near each object. Observe which are attracted to the magnet. Make a generalization as to which substances are attracted by magnets.

CONCEPT: Magnetism acts through most substances.

Place a piece of cardboard over a few tacks. Then place a magnet over the cardboard. The tacks will cling to the cardboard, attracted through it by the magnet. Try this experiment with paper, glass, cloth, and other materials.

CONCEPT: The strongest magnetic force of attraction is usually at the ends of a magnet.

Hold the middle of a magnet near different iron objects. Do the same with the end of the magnet. There should be an observable difference in power of attraction between the two parts of the magnet. Dip the magnet into a package of small iron tacks or iron filings. The ends of the magnet should be more fully covered than the middle.

CONCEPT: Magnets have a north pole and a south pole.

Explain that the two ends of the magnet are called "poles". They have been given the names "north" and "south" poles.

CONCEPT: Magnetic poles which are unlike attract each other. Magnetic poles which are alike repel each other.

Take two bar magnets. Bring them together so that the two unlike poles (north and south) touch each other. Note the tendency for them to be attracted to each other. Now bring two like poles (north and north, or south and south) together. Note that there is a tendency for the two magnets to push each other away. Take two U or horseshoe magnets. Bring the ends together. In one position they will attract each other because unlike poles are being brought together. In the other position they will repel each other because like poles are being brought together.

CONCEPT: Magnetism can be induced (borrowed).

Hold a large nail against a magnet. Then dip the nail, still clinging to the magnet, into a bunch of small tacks or iron filings. The nail attracts the tacks as if it were a magnet. Now take the nail away from the magnet. The tacks will drop off; the nail is no longer magnetized. The nail became a temporary magnet because of induced, or borrowed magnetism. At times a very small amount of magnetism, called "residual magnetism", will remain for a short time, causing a few tacks to remain clinging to the nail.

CONCEPT: Magnets have force fields.

Note how far a magnet can be from an iron object before it attracts it. Place two magnets on a table so that their like poles are together. By moving one magnet with your hand, make the other one move because of the repelling action. Put the like poles together and see how far one magnet must be to the other before they jump together.

CONCEPT: A force field can be demonstrated with iron filings and a bar magnet.

Put some iron filings in a salt shaker. Place a piece of glass, stiff cardboard, or paper over a bar magnet. Sprinkle iron filings over the glass. Tap the glass gently and see what pattern the filings take. The pattern will usually seem to be built about lines, most of which are curved and tend to connect the poles of the magnet. These lines are called "lines of magnetic force".

CONCEPT: Magnetic compasses are used to tell direction.

Suspend a bar magnet so that it can swing freely. Allow it to stop swinging. It should come to rest approximately in a north-south direction, following the earth's lines of magnetic force. A compass works on the same principle. The "needle" is a small compass, pointing north because it is lining up with the earth's magnetic field.

CONCEPT: A compass may be made with simple materials.

Provide a pin, two needles, a 2-inch square of cardboard, a piece of paper 2 inches X 1 inch, and a magnet. a) Magnetize both needles by stroking about 50 times with one pole of the magnet. Stroke both in the same direction, from eye to point. b) Push the pin through the cardboard, with one point up. c) Fold the paper into a shallow V. Push a magnetized needle into each side of the V with both eyes at one end and both points at the other. d) Balance the V on the point of the pin. The V will come to rest with one end pointing to magnetic north.

Experiments to do with the compass.

1. Which end of the instrument is pointing north? (Hint - shadows at

noon lie to the north of the object casting the shadow).

2. Which objects in the classroom are made of iron or steel? (Hint - hold the compass near each object being tested. One end of the V will point toward iron or steel, even when the object is covered with paint or concealed within wood and plaster.)

## III. SOUND

CONCEPT: Sound is caused by vibration. (Be sure the child knows the definition of "vibration".)

1. Strike a musical triangle to make it vibrate. Listen to the sound. Touch it to stop the vibration and also the sound. Strike it again and put it into water. Note the waves of water caused by the vibration. A tuning fork may be used for this experiment if one is available.

2. Stretch a rubber band. Pluck it with your finger and listen to it. Stop it from vibrating and observe the sound stop. (A discussion may continue from this experiment about stringed instruments.)

3. Touch your throat with your fingers while making a sound. Feel the vibration. Stop the sound and feel the throat - the vibration has stopped.

4. Beat a drum and feel the vibration.

CONCEPT: Sounds differ in loudness, pitch, and quality.

Experiment with different materials and objects to determine the difference in loudness, pitch (high and low), and quality (the texture of a tone). A C note on a piano and on a violin can be the same in loudness and pitch, but are different in quality.

CONCEPT: Pitch depends on the speed of the vibrations.

1. Stretch a rubber band across the opening of an empty cigar box and pluck it. Listen to the sound. Now stretch the band tighter and again listen to the sound. The tighter it is stretched, the higher the sound will be.

2. Stretch a thick rubber band and a thin rubber band across an empty cigar box, stretching equally tight. Pluck both and listen to the sound. A thin rubber band gives a higher pitch than a thick one. With a magnifying glass, the children may be able to see that the above two experiments are so because of the speed of the vibrations.

3. If possible, get a violin or other stringed instrument. Notice the effect of loosening and tightening the strings, and the difference between thick and thin strings. The effect of the length of the string on the pitch can also be seen on the violin. Pressing down on the string keeps part of it from vibrating. Thus, the shorter the string, the faster the vibrations, and the higher the pitch.

CONCEPT: Sound can be reflected.

1. Have the children listen to their voices in a bare, vacant room such as a gymnasium. Notice how their voices seem to "bounce" off the walls.

2. Have discussions of echos.

CONCEPT: Sound travels.

1. Discuss experiences the child may have had of seeing something happen before hearing the resulting sound (seeing airplane, then hearing it).

2. Divide a group of children into two groups and put them about 500 feet apart. Have one group provided with a good whistle and the other group with a flag. The group with the whistle blows it loudly. The group with the flag signals as soon as it hears the whistle. The whistle group thus observes that it takes some time for the sound of its whistle to reach the other group.

CONCEPT: Sound travels better through wood than through air.

1. Place a clock on top of a wooden desk or table. Have a child place his ear on the table top near the clock. Keep moving away until he can barely hear the clock ticking. At this point, have someone hold the clock in the air. The child will no longer be able to hear the clock tick.

2. Listen to the ticking of a clock. Hold one end of a yardstick to the child's ear and the other end on the clock. The sound of the ticking will be louder through the wooden stick than through the air.

CONCEPT: All musical instruments produce sound by vibration.

1. Examine stringed instruments. Observe the strings vibrate when plucked. Experiment to see how length and thickness of the string affects pitch.

2. Examine woodwind instruments. Observe the reed in the mouthpiece and the ways to change pitch.

3. Examine a brass instrument. Observe the mouthpiece and either from books or from a music teacher, learn how the player's lips help produce the desired pitch.

4. Examine many kinds of percussion instruments. Observe how they are played in order to produce vibrations.

CONCEPT: Teeth, tongue, and lips help control the sounds people make.

1. Have a child begin to pronounce the letters of the alphabet, pausing after each letter to note the position of tongue and lips.

2. Have a child sing on the same pitch the sounds aw, oh, oo, ee. Note the changing position of the mouth.

3. From these experiments, a discussion may be formulated of the importance in pronouncing the sounds in words clearly so that they may be understood.

Activities related to sound.

1. Make flowerpot chimes. Hang flowerpots of graduated sizes upside down from a stick extended from one chair back to another. The flowerpots may be hung by the use of twine attached to buttons large enough not to slip through the hole in the bottom of the flowerpot. Any small, hard object may be used to strike the chimes.

2. Make a xylophone. Arrange pieces of hard wood sawed to graduated lengths and placed across two longer pieces of wood as in a real xylophone. A scale should be able to be played if care is taken in the lengths of wood. With practice, simple tunes can be played. Strike the wood pieces with a large nail or other hard object.

3. Drinking glasses or test tubes filled with different amounts of liquid can be arranged so as to produce a scale. Sounds may be produced by blowing across the tops of the glasses or test tubes.

4. Make a rubber band harp. Stretch several rubber bands of varying lengths and thicknesses across an empty box or some other suitable frame. When plucked, different notes of the scale can be produced.

5. Make a tin can telephone. Cut the tops from two tin cans so that there are no sharp edges. Punch a hole in the bottom of each of the tin cans. Run one end of a 25 foot piece of string through the bottom of one can, and the other end of the string through the bottom of the other can. Tie knots in the ends of the string so that the ends cannot slip through the holes. Wax the string by rubbing it from end to end with a cake of paraffin. Have two children hold the cans and move apart so that the string is pulled tight. Then have them talk to each other over the line. Each can has to be used both as a transmitter and as a receiver.

## IV. PLANTS

CONCEPT: Some plants keep their leaves during the winter and are called evergreens. Some plants lose their leaves during winter and are not evergreens.

Take a walk around the school grounds or home during the winter and observe which plants have their leaves and which don't. Try to discover the names of some of the plants.

CONCEPT: Bulbs need water to grow. Bulbs need light to grow green leaves.

Plant two narcissus bulbs in each of three bowls by covering them with small rocks. Label the bowls: 1. Water 2. Water 3. No water. Place the three bowls in a cool, dark place after water has been added to 1 and 2. Check 1 and 2 each week and add water when necessary. Observe and make a record of what happens. When the leaves are about four inches high, move 1 to indirect light. Identify this bowl by adding the word "light" to the label. After one week, place 1 near a window so that it will receive some sunlight. Continue to add water as necessary. Add the words "no light" to the label for 2 and keep this bowl in the dark, adding water as needed. Continue recording the observations. Observations should include the following: Bowl 1, yellow leaves with just water; green leaves with water and light. Bowl 2, yellow leaves with just water. Bowl 3, no leaves or very small leaves with no water and no light.

CONCEPT: Lima beans need water to germinate.

Fill two containers with lima beans. Add water to one and put both containers on a window sill. Observe to draw the conclusion that water is necessary for germination.

To continue with this experiment, go on to the following activity. Use six large flat dishes or pans to hold collections of 50, 100, 150, 200, 250, and 300 beans. Graduated cylinders should be available to measure water volume. Place the beans in a single layer with space between and add 200 milliliters of water to each pan. Cover the pans to retard evaporation. The next day, observe the beans, note any changes, and pour off the remaining water. Determine how much water has been used. After all information has been recorded, again add water and continue with the same procedure. Guide a discussion to relate number of beans and amount of water used. Try to answer the following questions: Does the amount of water used depend on the number of beans present? Will twice as many beans take in twice as much water? How much water will a bean absorb? If the child has had experience with graphing, or if the teacher has time for an explanation, a graph can be made comparing the water used with the number of beans. From this, predictions can be made for different amounts of beans, and experiments carried out to prove or disprove the predictions.

CONCEPT: There are several kinds of a parasitic plant called a mold. Molds grow on a variety of materials.

Use several containers that can be covered tightly with clear plastic food wrap. Transparent refrigerator bowls, plastic sandwich boxes, or small jars work well. Put a layer of soil rich in organic material about ¼ inch thick on the bottom of the containers. Mix into the soil a small amount of shredded green leaves or the greenest outside leaves of lettuce or celery. On top of this soil, place the various materials on which mold will grow. (Bread, cheese, fruit, onions, baked potato, coffee grounds, tea leaves, paste made with flour and water, cooked cereal). Place the containers in warm, dark places and take them out each day to observe any changes. Discuss the various shadings in color of the different molds, the shape and size of the various colonies. (Introduce the word "colony".) To compare materials on which mold will grow, put chalk, thumbtacks, a pencil, or a crayon in similar containers under similar conditions and observe that mold does not form. Keep pictorial and written descriptions of the observations. Study the molds under a magnifying glass or a microscope.

CONCEPT: A seed has three main parts.

Place lima beans in water overnight to hasten germination. Then place them on damp paper towels for two or three more days. Have the children take a bean apart (toothpicks are good for this) and identify the covering, tiny plant, and stored food. Discuss the function of each main part.

CONCEPT: Seeds cannot develop into a plant without the stored food.

Take apart a lima bean seed as described above. Gently remove the tiny plant from between the halves of the seed and plant it in water or soil. Observe whether it will live or die. (It will die because it needs the stored food.)

CONCEPT: Plants reproduce in several different ways.

Obtain some seeds, bulbs, slips from plants such as ivy or geraniums, a strawberry plant, and a potato. Plant the seeds and bulbs and observe how they grow. Place a cutting or slip from a geranium or ivy plant in water or moist sand, and observe the roots form to grow another plant. (Pussy willows brought to school often start roots and may be planted to grow into willow trees.) Plant a potato in a narrow glass container and observe the underground stems of the potato grow into a plant. See where the roots develop and where the stems come from. If the potatoes are allowed to continue growing, the shoots can be observed coming above the ground and the development of leaves. A strawberry plant growing in rich soil in a large flowerpot will send out runners and show how new plants are developed.

CONCEPT: The parts of a flower are important in plant reproduction.

Examine a flower closely to discover its main parts. (A tulip, tiger lily, or day lily is good to observe the parts.) Through reading or discussion, the child should understand that pollination is necessary to make fertile seeds, that seeds are formed in the bottom part of the pistil, that the pollen is on the top of the stamen (the anther). The parts of the flower need not be memorized in order for the understanding to be present. Present the understanding that bees and other insects aid in pollination. A good film on this subject would be appropriate and very helpful in the understanding of this concept.

<u>CONCEPT</u>: The leaves on a plant are arranged so as to receive a maximum amount of light.

Examine the leaf arrangement on several plants. Observe that the leaves may be distributed in pairs on opposite sides of the stem and at right angles to the pair beneath and above, in whorls with three or more leaves growing out from the stem in a kind of circle, or in an alternate pattern.

<u>CONCEPT</u>: Leaves seek light and roots seek water.

Place lima beans on a desk blotter that has been placed between two squares of glass about 10 inches square. Bind the two pieces of glass together to hold the beans in place. Place the glass and beans in a pan of water. The blotter will absorb the water and keep the beans moist. In a few days the seeds will sprout and the roots will turn down to seek water while the shoots will turn up toward the light. After a few days turn another side into water. Notice that within a few days the roots and shoots change their direction of growth. The shoots still seek light and the roots grow toward the water.

<u>CONCEPT</u>: Warmth affects seeds.

Prepare two groups of lima bean or radish seeds for germination. Place one group in the refrigerator, and the other in a warm place. Observe which group of seeds germinates first.

<u>CONCEPT</u>: Water goes into plant roots.

Use a carrot with a fresh leafy top. Cut off the top and let the root part stand overnight in a glass of water tinted with Easter egg dye, food coloring, or ink. (Red is the best color to use.) The next morning, cut off a circular piece and then cut the carrot lengthwise. The pathway of the water inside the root will show clearly.

<u>CONCEPT</u>: Water (and sap) goes up plant stems into the leaves.

Set a celery stalk in colored water. After several hours the sap and leaf veins will be colored. Split a fresh stalk of celery part way and place one end in water of one color, then set the other end in water of a different color. Observe how the leaves become tinted.

<u>CONCEPT</u>: Leaves give off moisture.

Fasten a cellophane bag around a cluster of leaves on a tree or potted plant. After a few hours the bag will be lined with moisture from the leaves.

<u>CONCEPT</u>: Plants have three main parts: roots, stems, leaves.

Through reading or discussion present the following facts: roots collect water and food from soil; the stems pass this food to the leaves; leaves are living factories that make foods. Examine several varieties of plants, including trees, to find the three main parts.

<u>Activities to be done away from the classroom</u>.

1. Take a walk to see different plants; look for different kinds of trees, shrubs, vegetables, weeds, and flowers. Compare them to see how they are alike and how they are different.

2. Look for ways in which people use plants in our daily living for food, clothings, play, work, etc.

3. Make a collection of plants used for food or for clothing.

4. Visit a greenhouse to see different kinds of plants, to see how plants are cared for, and to see how new plants are started.

# V. WATER

CONCEPT: Water expands when it turns into ice.

Fill two pint milk cartons with water. Make the tops secure by tying them shut with string. Leave one carton in the classroom. Put the other carton outdoors during a freezing day, or in the freezer of a refrigerator. Observe the two cartons after a day has passed. The carton left in the classroom should look normal. The other carton with the frozen water should be bulging or may have burst. Conclusion: when water freezes it expands and takes up more space.

CONCEPT: Water turns to ice at 32 degrees Fahrenheit.

Place a dish or carton of water in a refrigerator set at 32 degrees F. Observe the formation of ice.

CONCEPT: Water evaporates.

1. Place a flat dish of water in the window sill. Mark the level of water each day. The water level goes down because the water is evaporating.

2. Moisten a paper towel. Spread it out flat. Check it $\frac{1}{2}$ hour later. It will be nearly dry. The water has evaporated.

3. Discuss drying clothes on a line. They dry because the water in them evaporates.

CONCEPT: Evaporation takes place only where water touches the air.

Put water in a jar with a lid, a jar without a lid, a shallow dish, and a bottle with a narrow neck. Observe the speed of evaporation in each container. The water inside the closed jar does not evaporate because the water does not touch the air. The water in each of the other containers will evaporate at a different rate, fastest from the shallow bowl because more water surface is exposed to the air.

CONCEPT: Water evaporates faster if there is wind blowing on it.

Mark off two places the same size on a blackboard. Rub both of them with a wet cloth. Fan one of them. It will dry first.

CONCEPT: When water comes out of the air, it is called "condensation".

Put ice cubes in a jar and fill it with water. Cover the jar and let it stand. Soon the outside will be wet. The water came from the air. In nature, this form of condensation is called "dew".

CONCEPT: Rain is caused by condensation.

1. Put a saucer of water in the bottom of a dry aquarium. Cover the aquarium with a dry glass cover. Moisture will have condensed on the glass by the next day, and will fall off in drops if left long enough.

2. Heat water in a teakettle. Hold a jar over the spout of the kettle. Droplets will gather inside the jar.

CONCEPT: Heat speeds up evaporation.

Place equal amounts of water in two similar containers. Place one on the radiator and the other in a cool place. The warm one will evaporate faster.

CONCEPT: Water can exist in three forms. Heat is required to change water from one form to another.

Bring some ice into the room. As it warms up, it turns into a liquid. Heat the water to boiling and observe the liquid turn into a gas, or steam.

# VI. AIR

CONCEPT: Hot air rises.

Light a candle. Hold a piece of paper above the flame and observe how close it can be held before burning. Hold the same type paper to the side of the flame and observe how close it can be before burning. Conclude that hot gasses and air rise, and do not go sideways. Further discussions may be had about air from radiators and registers rising in a room, and the fact that heat rises from the earth when the sun heats it.

CONCEPT: Air is composed of about 1/5 oxygen.

Use melted wax to fasten a candle to a small plate which is set in a larger dish containing water. Light the candle and place an inverted glass jar over both plates. The flame goes out as soon as the oxygen in the jar is exhausted. The water will rise to fill about 1/5 of the space in the glass jar. It does this because the oxygen has been used up.

CONCEPT: Air takes up space.

1. Put a small cloth or kleenex in the bottom of a glass. Turn the glass upside down and push it straight into the water. Pull the glass out of the water and pull out the cloth. It will be dry. Air in the glass took up space and did not let the water into the glass. Push the glass into the water and tilt it so the air comes out. Observe the water going into the glass.

2. Use a pop bottle, a small funnel, a soda straw, modeling clay, and a cupful of water. Seal the funnel tightly into the neck of the bottle with modeling clay. Pour the cup of water into the funnel quickly. The water stays in the funnel because the air in the bottle can not get out.

To fill the bottle with water, you must let the air get out. Pass the straw through the funnel into the bottle. Suck out a mouthful of air. Down goes some water, taking the place of the air you have removed.

CONCEPT: Air pushes in all directions.

1. Fill a glass with water. Press a piece of stiff paper to the top of the glass so no air can get in. Holding the paper on, turn the glass over. Release the paper. It will not fall off because air pushed on the paper and held it to the glass.

2. Put some water in a straw. Hold your finger over the top. The water will not run out. Air pushes up and keeps the water in the straw.

3. Put a bottle of water upside down in a pan of water. Blow air into the bottle by use of a flexible tube. The air will push out the water. Now suck air out of the bottle, using the tube. Water will go into the bottle to take the place of the removed air. Water moves in because air pushed on the water in the pan.

4. Peel an egg that has been boiled for fifteen minutes. Press it into the mouth of a quart milk bottle. The egg is held in the rim because air underneath pushes up against it, keeping it from falling. Crumple a paper napkin and light its lower end. Quickly drop it into the bottle. Quickly place the egg back on the bottle rim, pointing end downward. The egg will go into the bottle. As the air in the bottle was heated, some of it escaped. Air from the outside could not get in after the egg was placed over the mouth of the bottle. The greater pressure above the egg forced it into the bottle. To get the egg out, tilt the bottle so that the egg rests in the neck. Press the mouth of the bottle firmly against against your lips.

Blow into it as hard as you can. As you do this, you increase the air pressure in the bottle. Then move your mouth away. Out comes the egg.

5. Punch a small hole in the bottom of an empty can that has a screw top. Fill the can with water and cap it quickly. Notice what happens. (No water flows from the hole.) Now remove the cap. The water flows freely. With the cap on, air pushed up harder than the water pushed down, thus holding the water in the can. With the cap removed, the air pressure on top plus the water pressure was greater than the air pressure pushing up.

CONCEPT: Air has weight.

1. Make a simple balance from two straws pushed together, held up in the middle by a piece of thread. Blow up two balloons of the same size and fasten them to the straws so they will balance. With a pin, prick one of the balloons. As the air rushes out, the pricked balloon goes up and the air-filled one goes down, showing that the balloon filled with air weighs more than the empty one.

2. Weigh a flat basketball on some accurate scales. Pump the ball full of air. Weigh it again and observe the weight gain due to the air.

CONCEPT: Hot air expands.

1. Fit the neck of a balloon over the mouth of a small pop bottle. Set the bottle in a pot of cold water. Heat the water, and the air in the pop bottle will also be heated. The air will expand. The balloon will stretch and get larger.

2. Blow some air into a balloon until it is just rounded with no wrinkles. Hold it over a hot plate (not too close) or a pan of boiling water. The air inside will become warm and will expand, making the balloon larger. Measure the balloon before and after heating with a measuring tape.

## VII. ASTRONOMY

CONCEPT: Rotation of the earth causes night and day.

Darken the room. Use a strong flashlight, or some other beam-type light source, and explain that this represents the sun. Use a ball for the earth. Hold the light steady, shining on the ball. Rotate the ball and observe how a marked point appears in the light (day) and then in the dark (night).

CONCEPT: The moon revolves around the earth.

Explain and show with models (use different size balls for the moon and earth) how the moon revolves around the earth. Be sure to include the fact that one face of the moon always faces the earth; we cannot see the other side of the moon unless cameras on satellites take pictures.

CONCEPT: The moon has phases because of its movement around the earth.

In a darkened room, have the child stand in a light source. Have another child hold the "moon" (a large ball) between him and the light source, and then slowly walk around the first child. The first child should observe the different "phases" or the different amount of lighted surface he can see as the moon revolves around him. (He represents the earth.)

CONCEPT: An eclipse of the sun or moon is caused by the movements and lining up of the moon, earth, and sun.

Use a light source for the sun, a large ball for the earth, and a smaller ball for the moon. To show an eclipse of the moon, rotate the moon around the earth so that no light from the sun is able to shine on it. The earth has blocked the light and the moon is eclipsed. To show an eclipse of the sun, rotate the moon so that it is between the earth and the sun, blocking the sun from viewers on the earth. Note that the three bodies must be exactly in line for the eclipse to occur.

CONCEPT: Planets revolve around the sun.

Have several books available that discuss the planets. Charts can be made comparing size, distance from the sun, number of moons, temperature range, length of day and year, etc.

Activities concerning astronomy.

1. Constellation charts may be prepared at school for use at home in the following manner. Cut cardboard discs three inches in diameter. Make an outline of the constellation and use a nail to punch out the positions of the stars on the cardboard. The disc can be fastened to one end of a tin can which has both ends out. By holding the can to a light the pattern of stars may be easily recognized and compared to the stars in the sky.

2. Another constellation chart may be made by lining a small cardboard box with aluminum foil. At one end cut a hole large enough to insert a flashlight. At the other end, fit pieces of cardboard sheets that have the stars of one particular constellation punched through them. When the flashlight is turned on and the room darkened, the constellation can be shown on the ceiling. The child may present his own star show, showing several constellations, naming them, and telling their location in the night sky. These may also be used to help identify the real constellations during an evening sky watch at home.

3. Teach or let the child teach himself (with guidance) about meteors, meteorites, comets, asteroids, galaxies, and other matter in space as his

interests and abilities allow. Many books can be obtained from nearly any library on the subject of astronomy.

4. If a planetarium is available in the community, make an effort to get the child acquainted with it and some of its personnel.

5. A telescope can be very useful and interesting in the study of astronomy. Acquaintance with a person who owns a telescope or perhaps the purchase of one by the child's family should be encouraged.

## VIII. HEAT

CONCEPT: Heat makes some things expand.

1. Get a clean, dry empty jar with a screw top. Turn the cover on so tightly you can't open it easily. Run hot water over the top until the cover is hot. Turn the cover. It opens easily now because the metal cover expanded.

2. Get a piece of thin bare wire (a single strand of picture wire will work). Also get a screw driver and a kitchen chair with a back, and a candle. Tie one end of the wire to the screw driver, about one inch from the tip of the blade. Tie the other end of the wire to the top of the chair back, so that the screw driver blade is just under the bottom rung of the chair. Hold the lighted candle half way up the wire. The candle heats the wire and causes it to expand. The screw driver handle will dip down because the wire slowly grows longer. Now remove the candle. Wait for the wire to cool and watch the screw driver ride up slowly as the wire becomes smaller and shorter.

3. Get a weather thermometer and two dishes. Notice at what number the top of the liquid in the thermometer is. Fill one dish with hot water

and one dish with cold water. Dip the thermometer in each dish, holding it in each for about one minute. Watch the liquid get higher in the hot water, and lower in the cold water.

4. Other things that expand with heat are the following: sections of railroad track are laid with open spaces between them, thus leaving room for the tracks to expand on hot days; cement sidewalks are made with cracks to allow for expansion.

CONCEPT: Some materials conduct heat.

1. Get a cup almost full of hot water and a silver spoon. Set the spoon in the hot water. Hold the tip of the spoon handle. Feel the heat come into your fingers.

2. Get a small piece of ice and a coin. Put the coin on the piece of ice. Watch it melt a round place in the ice. The coin isn't very warm, but it's warmer than the ice, so the heat moves from the coin into the ice and melts it.

CONCEPT: Some materials conduct heat faster than others.

1. Get a saucer, a piece of cloth, and two ice cubes. Put one ice cube on the saucer and one on the cloth. Hold the saucer on one hand and the cloth on the other hand. The hand with the saucer feels colder. Heat flows through the saucer faster than through the cloth.

2. Get one ice cube, a wooden match and a nail about as big as the match. Hold the match in one hand and the nail in the other, and touch them both to the ice cube. The metal nail feels colder than the wooden match. Heat runs faster through metal than through wood. Try this experiment with different materials.

CONCEPT: Dark objects absorb heat more readily than light ones.

Get two tin cans of the same size and make a hole in the top of each big enough so that a thermometer may be inserted into each can. Cover one can with black paper and one with white paper. (The cans may be painted black and white.) Put both cans in the sun and record the temperatures shown on the thermometers. Using the results of this experiment, discuss the wearing of clothes during the summer and winter seasons and which colors would be appropriate.

CONCEPT: Different materials hold different amounts of heat.

Place a piece of metal and a piece of wood of similar size (a steel ball bearing and a block of wood work well) in boiling water. Leave for several minutes. Remove and carefully determine which one cools faster. The metal holds heat longer than wood. Experiment with different materials.

CONCEPT: Heat makes water evaporate.

Moisten two paper towels. Place one on a radiator and the other in a cool place. Notice which one dries faster. Heat makes water evaporate faster.

## IX. ANIMALS

Primary teachers seem to teach more about animals to their classes than any other phase of science. However, the teaching is often confined to identification of a few of the more common animals, perhaps a unit on birds, and another on frogs and tadpoles, and care of pets. Usually there is a fish bowl in at least one primary room in the school, and at times children are allowed to bring their small pets for a short visit. Often this is the extent of the teaching about animals. Primary aged children, and particularly gifted children, are capable of learning much more about animals. The concepts and activities following should be taught only after some of the more basic learnings have been presented to the children. These might include these concepts: 1. All animals need food, water, and air in order to stay alive. 2. Pets need proper care. 3. Animals live all around us, on land, in water, under the ground, in the air, in trees, etc. The following concepts are capable of being learned by above average or gifted children in the primary grades.

CONCEPT: Animals have been classified into groups for the convenience of studying them.

1. Begin classification with such simple groupings as large and small animals, land and water animals, etc.

2. Advance into more complex groupings such as animals with legs and those without, animals that eat meat and those that eat plants, those that lay eggs and those that have their babies alive, etc.

3. After the basic groupings described above, the higher animals can be classified into mammals, birds, reptiles, fish, and amphibians. Characteristics and examples of each group should be learned.

4. After working with the higher animals, the child probably will become interested in the lower animals. Insects and spiders are interesting and quite simple to understand.

5. For the more capable and interested child, the lower animals may be studied in a quite detailed manner. The phylums can be learned and discussed. Each phylum might be studied or some in particular may be

singled out for detailed study.

6. Scrapbooks of pictures of the animals in various groups may be made. Biological supply houses' catalogs are good places to look for small pictures of many of the lower animals. (The school principal may have some old catalogs.)

7. If the child is competent in written expression, he may make a booklet of reports on the phylums or individual animals. Parts of larger animals may be examined. The microscopic animals may be studied if proper slides are available or if they can be identified by the child.

<u>CONCEPT</u>: Baby animals develop through many stages before they are born.

1. Obtain or build an incubator for chicken eggs. (Directions for building one are briefly as follows: a. Use a box about 20" in length and 14" in width and height. Put a glass window at the front of the box. Line the box with aluminum foil. Hook up a light bulb (a 40 watt bulb usually is suitable) and a thermostat. The temperature must be kept between 100 and 103 degrees Fahrenheit. A pan of water must be kept in the box at all times. Three or four $\frac{1}{2}$ inch vent holes should be made close to the top of the box. The eggs should be placed as close to the thermometer as possible to ensure proper heat. They should be turned half way over twice a day. In 21 days they will hatch.) In order for the child to see the different stages in development of the chick, open an egg every three days and place it in a jar of formaldehyde. These jars should be marked so that they can be used again for other children.

2. Obtain some frog eggs or toad eggs from a pond or stream, or let the children bring some in. Keep them in the pond water in a cool place until they hatch. Before they hatch examine them daily with a microscope.

Note the development inside the egg.

3. Use films and books to supplement the children's learnings in animal growth and development before birth.

<u>Other activities concerning animal study</u>:

1. Have an "Animal of the Week". Choose animals that are not well known to the children. Have books and pictures available and let them find out as much as possible about it. A booklet can be made of these animals.

2. Have a pet day when appropriate pets may be brought to school and be observed by the class.

3. Discuss man's dependence on animals and the importance of different types of animals to people in various parts of the world.

4. Make a list of the products used by children in one day that are provided by animals. Items such as food, clothing, feathers, fur and leather are appropriate.

5. Bring a kitten to the classroom and observe the claws on its feet. Observe how the kitten uses its claws and discuss their value in food-getting, in climbing, and for protection. Let this discussion lead to other animals and their methods of food getting, locomotion, and protection. (Protective coloration is interesting to primary aged children.)

6. Place some dry grass or hay in a jar of water and let this mixture stand in the room for a few days. With a medicine dropper, take some water from the surface of the mixture and place it on a microscope slide. Place a cover glass over the drop and examine it under a microscope. Many microscopic animals should be seen in the water.

7. Look for insects and other animals under stones or boards. Observe their activities when they are disturbed.

8. Encourage insect or other small animal collections.

9. Collect moth cocoons and keep them in the classroom until the adult moths emerge. Study the difference between moths and butterflies. Try to find a butterfly chrysalis and see the difference between that and a moth cocoon.

10. Collect and examine abandoned bird's nests. (Be sure it is abandoned.) Try to determine the kind of bird that built the nest. What materials are included in the nest?

11. Invite a pet shop operator to talk to the class about caring for different animals and the special equipment needed to provide adequate care for some of them.

12. Visit a zoo, pet shop, or farm where children may observe the feeding habits of various types of animals. Keep a record of each animal observed and the kind of food it eats.

13. Discuss communication between animals. Listen to bird cries. (They are available on records.) Find information on dolphins and porpoises and their complicated communications. Find information on ants and find out about their methods of communication.

14. Find out as much as possible about hibernation and the animals that hibernate. Bring a tree toad into class and provide it with a terrarium of soft dirt and sand, small plants, and leaves. In the fall the toad might bury itself and hibernate. Keep it in a cool place until spring. Then watch for it to awaken. Horned toads are likely to hibernate

in the classroom too.

15. Keep a common garter snake in the room. The home may be an aquarium with a top, or a wooden box with a glass top or front. There must be no cracks or the snake will escape. Air holes must be covered with screen. Put sand and gravel in part of the home and soft dirt and leaves in the other. Large stones and pieces of bark will enable the snake to rub off his skin when he sheds it. He should have water in a low shallow dish large enough for him to get into. Garter snakes feed on mice, frogs, worms and similar small animals. They may be trained to eat raw hamburger. If he doesn't eat for the first month, expecially during winter, don't be concerned. He should be turned loose if he doesn't eat after that length of time. (If it's winter time, he will die if turned loose. Snakes can quite easily be force fed by inserting a toothpick in his mouth lengthwise like a bit in a horse's mouth and placing a piece of hamburger in his mouth. The snake will usually swallow it.) Handle the snake carefully and avoid his mouth until he becomes tame, which is usually after only a few careful handlings. Support his body with one hand while holding him behind the head with the other. This will prevent you from being bitten and will not hurt the snake. The children will soon learn not to be afraid of a snake. Be sure to teach them about the dangerous ones they might encounter, such as a rattlesnake.

## X. USE OF A MICROSCOPE

Activities.

1. Have the children examine an object with their naked eye and with

the help of a magnifying glass. Discuss which is better to see small details with. Discuss advantages of being able to magnify an object.

2. Introduce a simple 10X microscope. (Most elementary schools have at least one; if not, borrow one from a junior high or the high school.) Examine the parts and explain the function of the main parts (platform, holding clamps, reflector or light, lenses, magnifying tube, focus knobs).[1] Discuss proper way of handling and carrying the microscope. (Use both hands to carry it - one supporting it from the bottom, the other holding it by the arm.)

3. Examine slides and discuss their care. (Keep clean, protect from chipping and breaking.)

4. Show how to place a slide on the platform or stage of the microscope. Stress the importance of not focusing the tube downwards while looking through the eyepiece; the lens will hit the slide and break it.

5. Let the child practice with very simple slides, such as words or parts of insects.

6. Encourage the child to make his own slides. Empty slides and cover glasses will need to be provided.

7. The microscope should be available for use at any time during the study of science. Many topics can be supplemented with its use. For example, in the study of animals, the parts of small animals can be examined. Microscopic animals can be studied if a powerful enough microscope can be obtained.

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[1]A drawing of a microscope with labeled parts can be found in Appendix A.

# CHAPTER IV

## SUMMARY AND RECOMMENDATIONS

### I. SUMMARY

This paper was a review of the literature concerning the teaching of science to gifted children in grades one and two. Chapter III was devoted to suggested concepts and ideas regarding the teaching of those concepts. No attempt was made to set up a complete curriculum for the teaching of science. It was suggested that a teacher planning to enrich her science program for the benefit of a gifted child could choose from the areas of science presented in this paper, and then select specific concepts to teach.

It is the writer's hope that after reading a number of the suggestions and ideas presented in this paper, a teacher would be more inspired to conduct a better science program in her classroom.

### II. RECOMMENDATIONS

1. A valid survey should be made of teachers' practices of enriching science for gifted children. Once such a survey was made, a more definite program and curriculum could be devised to take care of any deficiencies that may have been discovered.

2. An enrichment program in science for gifted children in grades one and two should be conducted on an experimental basis. The findings would prove whether such a program were worth while.

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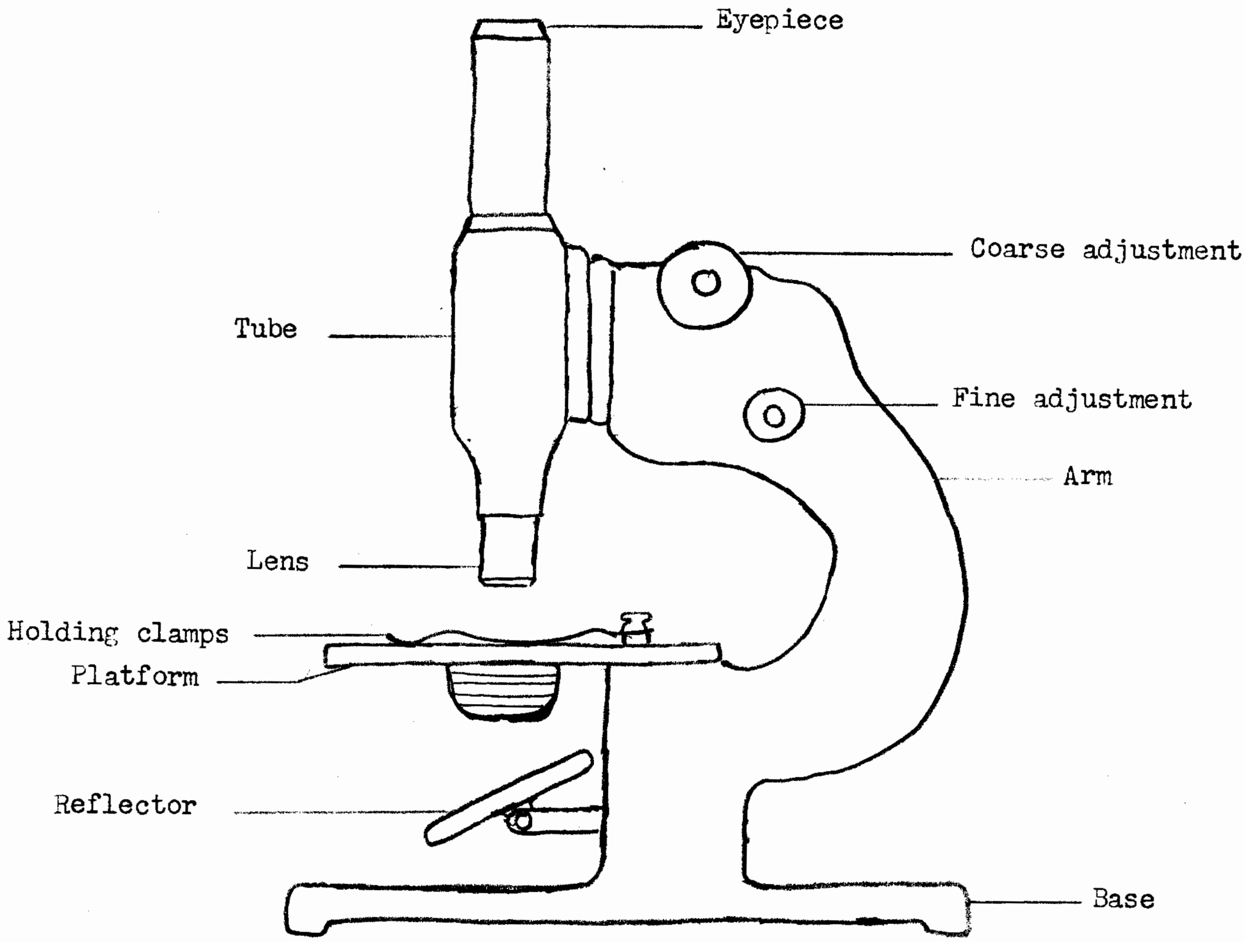
# APPENDIX

APPENDIX A


Eyepiece
Coarse adjustment
Tube
Fine adjustment
Arm
Lens
Holding clamps
Platform
Reflector
Base